

Texas Tech University Energy Savings Program FY 2016 Update

The Texas Tech Energy Savings Program Update is being submitted in accordance with Governor's Executive Order RP-49, Energy Conservation by State Agencies and Health and Safety Code, § 388.005(f).

A. Energy Goals

1. University Energy Use

Energy units are converted to thousands of BTUs per square foot (kbtu/ft²) to allow for comparisons of the various energy forms. Goals and energy use are therefore stated in kbtu/ft². Estimated savings are measured against energy consumption for the prior fiscal year.

For FY16, the campus consumed 151.79 kbtu/ft², a decrease of 0.38 kbtu/ft² (-0.2%) from the previous year. The goal was to reduce energy use to 150.5 kbtu/ft². Texas Tech fell short of the goal by 1.15 kbtu/ft² for the following reasons:

- Research space increased by 112,145 ft² and increased the EUI by 1.13 kbtu/ft². Research space is more energy intensive than other spaces, so an increase in research space will decrease the campus efficiency.
- Operations Division discontinued their practice of securing steam to campus during the summer, which impacted the EUI by 1.06 kbtu/ft². This measure was implemented to accommodate new building air handler design, reduce the maintenance effort, reduce the incidents of tuning errors, and allow for steam system audits and the correction of root causes of energy waste. The electronic maintenance foreman reports that 19 steam valves were repaired or replaced this summer. Energy Management will monitor the impact of these ongoing efforts by cusum analysis.
- Winter storm Goliath increased the EUI by 0.25 kbtu/ft². Texas Tech reported to FEMA a cost estimate of \$31,591 due to energy used December 26-29, the three most severe days of the storm.

The energy expense increased by \$283,163 this year due to space increases, though efficiency (EUI) improved slightly.

In Table I, the campus energy use is broken down by utility type.

Table I: University Energy Use (kbtu/ft²): **September '15 – August '16**

Utility	FY15 Actual	FY16 Actual	% Change from previous year	Estimated Savings
Electricity	54.12	56.13	Up 3.7%	-\$352,224
Natural Gas	98.05	95.65	Down 2.4%	\$68,830
Cogeneration Steam	0.00	0.01	N/A	\$231
Total	152.17	151.79	EUI is Down 0.2%	-\$283,163

2. House Bill 3693, Regular Session, 2007

In compliance with House Bill 3693, Texas Tech University had set a goal to reduce total electrical consumption by 2.5% for FY16. Table II shows the kilowatt hours per square foot (kwh/ft²) for the campus in Lubbock County.

For FY16, electrical consumption is 16.56 kwh/ft² for the year and is up 3.7% compared to FY15 (15.97 kwh/ft² for the year). This increase is attributable to the 1.25% increase in campus area, most of which is research space which is typically two or three times more energy intensive than classroom space, and the operation since May of two new electric powered chillers which replaced a 6,500 ton steam powered chiller. The new electric chillers consumed an additional 2,200,000 kwh. Operation of the electric chillers allows Texas Tech to preferentially use electricity instead of steam whenever gas tariffs exceed electricity tariffs.

Table II: Campus Electricity Use (kwh/ft²): **September '15 – August '16**
(Lubbock County)

Whole Campus Electricity Use in kwh/ft ²	FY 15 Reference Data in kwh/ft ²	2.5% Reduction Goal in kwh/ft ²	FY 16 Actual Consumption in kwh/ft ²	Percent Increase/Decrease from previous year, by quarter
1 st Quarter	3.97	3.87	4.19	Up 5.4%
2 nd Quarter	3.99	3.89	3.98	Down 0.3%
3 rd Quarter	3.86	3.76	4.00	Up 3.7%
4 th Quarter	4.15	4.04	4.39	Up 5.9%
Yearly Total	15.97	15.57	16.56	Up 3.7%

3. Fleet Fuel Management Plan (Vehicles)

Texas Tech University set a goal to reduce its consumption of gasoline by 11,412 gallons for Fiscal Year 2016 (a 5% reduction).

In FY16, Texas Tech's consumption of gasoline increased by 4,768 gallons versus FY15. Fleet size also increased by 2 vehicles during the same period.

Table III: Historical University Vehicle Fleet Data **September '15 – August '16**

	FY15 Gallons Consumed	FY16 Goal (5% Decline)	FY16 Gallons Consumed	Percent Change
1 st Quarter	61,090	58,036	64,082	Up 4.9%
2 nd Quarter	46,942	44,595	53,744	Up 14.5%
3 rd Quarter	57,380	54,511	63,541	Up 10.7%
4 th Quarter	62,832	59,690	51,645	Down 17.8%
Total	228,244	216,832	233,012	Up 2.1%

Table IV below compares the percent change of gas used to percent change in miles traveled for FY15 and FY16. It indicates an 8% increase in miles traveled.

Table IV: Miles Traveled

	FY14	FY15	FY16
Miles Traveled	2,475,460	2,654,632	2,866,994
Percent Change from Previous Year		7.2%	8.0%

Table V below indicates that fuel efficiency has increased by 5.8%. Additional highway miles may have contributed to our fuel efficiency.

Table V: Fuel Efficiency

	FY14	FY15	FY16
Miles per Gallon	10.2	11.6	12.3
Percent Change in Efficiency from Previous Year		13.7%	5.8%

4. Water Conservation (Thousand Gallons)

For FY16, water consumption was 306,500 thousand gallons and is up 11.6 % compared to FY15 (274,763 thousand gallons).

Metered well water is up 78.5%. Grounds Maintenance installed nine well water meters this year; so improved metering is capturing consumption that was not captured before. It is also true that the main TTU campus received 17 inches of rain this year versus 33 inches the previous year.

Domestic water is up 7.1%. Student enrollment is up 1.8% and probably accounts for 2% of this increase. About 5% is due to demolition of the Athletic Training Center; during demolition the 6th street well was out of service and as a result the Central Heating and Cooling Plant was forced to operate its cooling towers with purchased domestic water.

Table VI: University Water Use (Thousands of Gallons):

Utility	FY15 Actual	FY16 Actual	% Change from previous year	Estimated Savings
Domestic water	257,513	275,710	Up 7.1%	-\$18,197
Irrigation water	17,250	30,790	Up 78.5%	-\$13,540
Yearly Total	274,763	306,500	Up 11.6%	-\$31,737

B. Energy Reduction Measures

1. Educational and General Space

- a) Free Cooling Project at Central Heating and Cooling Plant #1 – The Water Side Economizer provided over 3,549,869 ton-hours of free cooling this fiscal year, an estimated savings of \$66,118.
- b) Back Pressure Turbine at Central Heating and Cooling Plant #1 supplied 16.6% of the CHACP's electrical use for an annual savings of \$146,228.
- c) Replaced a 6,500 ton steam driven chiller with two VFD driven electric chillers with a combined capacity of 6,200 tons. Project cost was \$6.2 million. TTU Energy Management will validate the energy savings in our FY17 report.
- d) Integrated automatic weather data, 15 chilled water meters and 20 electrical meters and 115 data points into the eSight Energy Accounting System. eSight has identified several repairs which have saved TTU over \$300,000 this past year; notably, a single chilled water repair at English/Philosophy/Education saved \$240,000. CHACP 1 Utilivisor service reports an annual savings of \$91,847. Installed nine irrigation water meters which have not yet been integrated into the eSight Energy Accounting System.
- e) Installed a second antenna at the College of Media and Communications to expand the coverage of our exterior lighting controls.
- f) Installed a dedicated cooling unit for Science lab 326. This unit provides the opportunity to discontinue 24/7 operation of the main air handling unit and save about \$17,000 annually.
- g) Installed a dedicated cooling unit for College of Media and Communications server room 1217, which allows the opportunity to discontinue 24/7 operation of the main air handling unit for the entire COMC tower. This measure is projected to save the university \$52,000 annually.
- h) Completed installation of View Dynamic Glass pilot project at College of Media and Communications room 102. The electronically dimmable glass is expected to reduce heat loads and improve occupant comfort and productivity. TTU Energy Management will study the installation in order to project savings of a full scope proposal for FY17. This project was sponsored in part by a gift-in-kind donation from View Dynamic Glass.

- i) Biology: Completed phases 1 and 2 of a three-phase recommissioning project at Biology. Electrical use appears to be down 7%. TTU Energy Management will validate this next year once steam and chilled water meters are installed and integrated into the eSight Energy Accounting System.
- j) Student Union Building: Performed a cost analysis of historical energy use at the Student Union Building. The analysis validated retuning work that Energy Management initiated in January 2015. Total energy cost reduced by \$58,000 in the past year.
- k) Energy Management successfully negotiated operational measures with customers at several buildings: Media Communications, Science, Art and Art 3D. The customers agreed to curtail their air handler exceptions by calling 742-40PS whenever they need service. By doing so, we have avoided energy costs of over \$100,000 per year.
- l) Agriculture Education and Communications Room 104 – Identified suite 104 was hot. Set up a project to correct duct work and install solar shades and blackout shades.
- m) Library: 75% completion of a retuning and controls project at Library. Electrical cost has decreased \$37,000 this past year. We are waiting for installation and integration of steam and chilled water meters into the eSight Energy Accounting System before we can validate the thermodynamic energy savings as well as the electrical savings.

The Dean of the Library saved over \$6,000 this year by securing air handlers during the winter break. She made only the Croslin room available as conditioned study space during this time.

2. Auxiliary Space

Rec Center: Energy Management validated a 43% energy reduction for the Robert Ewalt Student Recreation Center, for a multi-year project which they initiated in FY13. Rec Center energy costs have reduced by over \$268,000 annual since the program was initiated. The investment cost for these actions was about \$90,000.

3. Energy Audits

In FY16, Texas Tech completed two lighting audits at Drane and Reese 555. Twelve energy audits were completed for Media and Communications, Agriculture Education, Experimental Science, College of Business Administration, Food Technology, English Philosophy, Library, Petroleum Engineering, West Hall, Music, United Supermarket Arena, and Student Wellness to collect data for continuing energy analysis. Findings in Agriculture Education resulted in a project to replace the chilled water pump and variable frequency drive.

C. Energy Reduction Plans and Feasibility Studies

Texas Tech is currently planning energy efficiency measures such as:

- HVAC recommissioning and controls upgrades at McClellan Hall, Holden Hall, Wall Gates, Hulen Clements, Student Union Building, Music Building, Bayer Plant Science South and Southwest Collections
- Upgrading metering systems for electricity, heating, cooling, irrigation and domestic water, and integrating them into eSight Energy Accounting System to improve energy use monitoring and identification of excursions. Select electric meter data will be connected to Utilivisor for the purpose of balancing loads at the Central Heating and Cooling Plant #1.
- Pending results of the pilot study in College of Media and Communication 102, Operations Division will consider a proposal to install some View Dynamic Glass on the south face of the tower.

D. Fuel Consumption Reduction Plans

The Central Warehouse dedicated a driver and delivery vehicle to serve the whole Operations Division, thereby minimizing the number of campus runs. Savings are being validated.

The Vehicle Fleet Management office will network with vehicle custodians to exchange information on vehicle efficiency and solicit additional best practices and other preferred initiatives for the university vehicle fleet.

The Vehicle Fleet Office will facilitate an analysis of fleet usage within Texas Tech University and recommend best practices for future purchases.

E. Water Management Plan

Operations Division will develop a historical analysis of water efficiency and devise a long term water conservation strategy to include both domestic water and irrigation water. Ground Maintenance is currently installing irrigation meters for this purpose. The new irrigation meters and existing domestic water meters will be integrated into the eSight Energy Accounting System.